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## ENVIRONMENTAL GEOLOGY NOTES

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*from the Northeastern Illinois Office, Naperville*

# ACTIVITIES IN ENVIRONMENTAL GEOLOGY IN NORTHEASTERN ILLINOIS

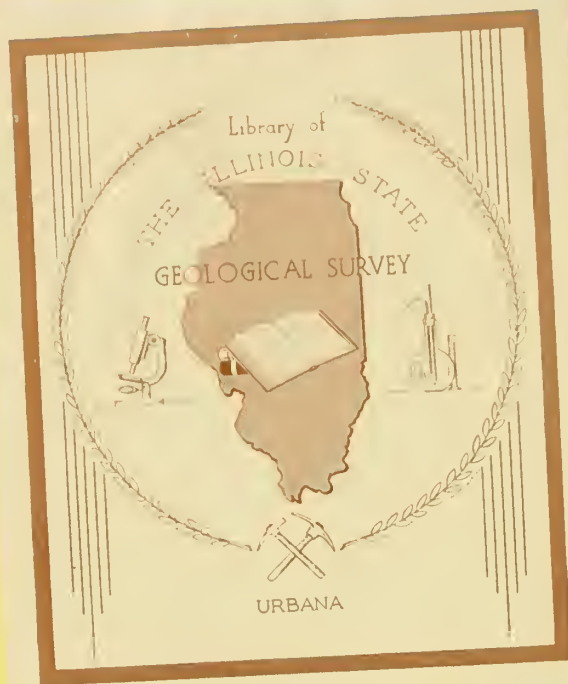
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ILLINOIS STATE GEOLOGICAL SURVEY

JOHN C. FRYE, Chief • Urbana



## ACTIVITIES IN ENVIRONMENTAL GEOLOGY IN NORTHEASTERN ILLINOIS

Jean I. Larsen and James E. Hackett

The Northeastern Illinois office of the Illinois State Geological Survey was established in 1959 to study the ground-water geology of the area but gradually has extended its responsibilities to include the application of geologic data to a diversity of areal planning and development problems created by the growth of the metropolitan region.

Environmental geology studies already completed have considered geologic conditions relative to open-space planning in DuPage County, geologic factors affecting refuse disposal in Winnebago County, the geology of the Chain-O-Lakes region in Lake and McHenry Counties, and the ground-water geology of Schaumburg Township, Cook County.

The field office is at present making studies of the materials framework and geologic properties in DuPage County.

### INTRODUCTION

The environmental geology program underway in northeastern Illinois was designed for the application of geologic information to some of the diverse problems created by human occupancy and use of the physical environment in a growing metropolitan region. It was a direct outgrowth of the activities of the Illinois State Geological Survey's office at Naperville.

The Northeastern Illinois office was established at Naperville in 1959 as a field office of the Geological Survey's Ground-Water Geology and Geophysical Exploration Section to conduct ground-water geologic studies in the Chicago region and to cooperate with State Water Survey personnel in the area. Since that time, much of its service activity has been concerned with providing information on geologic conditions relating to the potential for ground-water contamination resulting from the disposal of liquid and solid wastes. This information is used by state and county health departments in regulating refuse disposal.

In 1962 the Illinois Geological Survey undertook the geologic phases of a comprehensive water resources study of the six-county metropolitan area. The study was financed by State and Federal funds and was coordinated by the Northeastern Illinois Metropolitan Area Planning Commission.



The geologic phases of that study were completed in one year and included a geophysical program of earth resistivity, reflection-seismic, and gravimetric studies; the subsurface sampling of the unconsolidated deposits; and the compilation, analysis, and interpretation of all existing well data and other subsurface control for the purpose of making detailed hydrogeologic maps of the glacial drift and bedrock units.

As communication with health departments, planning agencies, public works groups, and various other boards and commissions at the state, regional, county, and local levels increased, the need became obvious for integrated geologic information that could be applied to diverse areal planning and development problems.

To bring the various kinds of geologic information together, a comprehensive approach is needed. As the scope of the program develops, it is essential to include geologic disciplines other than hydrogeology, although water resource and refuse disposal problems continue to be of first-rank importance in environmental studies. In considering the problems created by continual urban expansion and the strains created on the use of land and resources that accompany such expansion, a wide range of information must be readily available concerning such important geologic factors as topography and physiography, the engineering properties of earth materials, and the characteristics and distribution of potential mineral resources. The use of this integrated information can contribute advantageously to the solution of urban problems created by such activities as engineering construction projects, the development of mineral and water resources, the disposal of liquid and solid wastes, and the over-all planning and development of land use. With an approach that carefully weighs all of the relevant factors, the kind of metropolitan development best suited to the physical environment and most compatible with human needs and activities could be achieved.

As the scope of the environmental geology program is wide and necessarily includes many different geologic phases, the integration of all of the essential information into the program is far from completion. Many of the basic problems to be solved, however, have been carefully considered and the framework for the program has been fairly well established. A more comprehensive treatment of the elements of the environmental geology program will be found in a forthcoming Illinois State Geological Survey Circular entitled "Environmental Geology in the Chicago Region."

The projects and studies that have been conducted since inception of the environmental geology program at the Northeastern Illinois office, or are currently underway, are discussed briefly, following. These include both specific applications of available geologic information and research directed toward gaining new information needed for the program in general. None of the studies and reports described below has been published. They are, however, on file at the offices of the Geological Survey in Urbana and Naperville and may be consulted there.

#### COMPLETED STUDIES

##### DuPage County Open-Space Study

A study of the geologic conditions that relate to open-space planning in DuPage County was recently conducted at the request of the Northeastern



Illinois Planning Commission (NIPC) for use in their study of a long-range open-space acquisition plan for the DuPage County Forest Preserve Commission. In evaluating areas for future forest preserve development, emphasis was placed on the feasibility of multiple use of the land. The information was compiled to define several distinctive geologic environments, which were evaluated in terms of their suitability for land uses designated by the NIPC. The land uses given geologic consideration were (1) in-ground disposal of solid and liquid waste, (2) artificial recharge operations in the shallow aquifers, (3) industrial minerals development, and (4) surface and excavated reservoir construction that could be used for flood control, low-flow augmentation, and recreational purposes.

#### Geologic Conditions Relating to Refuse Disposal in Winnebago County

The Winnebago County Health Department was provided with a map of the county to help it in appraising the suitability of the two major geologic environments of the county for the location of refuse disposal sites. Environment I consists predominantly of fine- to medium-textured till uplands. The till is at least 50 feet thick and may exceed 80 feet. This geologic environment may be considered the one most likely to contain sites suitable for disposal of refuse as the pollution potential of the ground-water reservoir is not great. Environment II occurs in the lowlands and consists mainly of fine-grained silt and fine sand outwash in the upper part of the section, and may overlies aquifers. This environment is considered less favorable for disposal sites than Environment I because of the greater possibility of encountering saturated conditions and because it is more likely to contain coarse-grained, permeable deposits, which have a higher potential for ground-water pollution.

#### Geology of the Chain-O-Lakes Area

A summary of the geology of the Chain-O-Lakes region in Lake and McHenry Counties was made for the Division of Environmental Health of the Lake County Health Department to assist the division in research on the possible relations existing between waste disposal and water pollution in the Chain-O-Lakes area. It was found that the geologic environment consists largely of permeable sands and gravels at the surface that are separated from the underlying drift and bedrock aquifers by a relatively impermeable, fine-textured till that also underlies the Chain-O-Lakes proper. This till acts as a barrier that retards ground-water movement to the deeper aquifers. Two areas were found where a hydrologic connection between surface waters and deeper aquifers might occur. Others may also exist, but data in the Survey files is inadequate at present for locating or delineating them.

#### Ground-Water Geology of Schaumburg Township in Cook County

The ground-water geology of Schaumburg Township in Cook County was studied to establish the general relations existing between the geologic framework and ground-water occurrence. The study was requested by township officials, who are concerned with the impact of rapidly expanding urbanization on the ground-water resources of the township and are interested in instituting realistic conservation practices for future development. The existing aquifer systems were described and their potential for future ground-water development was evaluated.



## STUDIES IN PROGRESS

### Materials Framework and Geologic Properties of DuPage County

Both field and laboratory investigations are being conducted to determine the best methods of acquiring geologic information applicable to planning and development needs — that is, what mapping techniques are most practical and what determinations of properties are most useful.

Field investigations were started in the spring of 1964 and are still in progress. The major object is to map the character, occurrence, and distribution of the surficial materials and to relate them to subsurface elements to establish the geologic framework. Valuable geologic control is being gained from more than 3000 engineering boring records that were collected expressly for this program from both public agencies and private drilling concerns. A study of the sequence and correlation of glacial drift units also is being conducted so that deposits at the surface can be compared with those in the subsurface.

While the mapping program was in progress, 485 samples of surficial materials were sent to the Survey laboratories in Urbana. The samples were subjected to various physical and chemical tests, and for selected samples Atterberg limits, grain-size distribution, moisture content, soluble salts content, carbonate content, and clay mineralogy were determined. Statistical methods are now being applied to the results of the properties analyses to determine which properties are most typical of the surficial deposits in DuPage County. The final results will help determine what sampling and testing procedures are most appropriate for environmental geology mapping programs.

### Shallow Flow System in Northeastern Illinois

A cooperative study with the University of Illinois has been started to determine the basic elements of the ground-water flow in the near-surface zone in northeastern Illinois. Information on this flow system will have widespread application to a variety of engineering problems, pollution and contamination problems, mineral and water resource development, and land-use planning. The present method of study consists of inserting piezometers along several profiles in an area to determine the pressure potential at various depths. This will help to establish regional characteristics of the shallow flow system in various geologic environments and may make possible more specific determination of the direction of subsurface water movement for detailed mapping projects within the metropolitan region.

The possible use of chemical tracers, which would permit direct observation of subsurface water flow, also is being considered for this study. Although chemical tracers could not be used on a regional basis, they would be useful at selected sites.



## FUTURE STUDIES

Future studies in environmental geology at the Northeastern Illinois office will include special investigations of major geologic features essential for an adequate definition of the geologic framework and of geologic elements pertinent to planning and resource management projects. Later issues of Environmental Geology Notes will provide more detailed descriptions of the individual studies and of the general activities of the Northeastern Illinois office.

## ENVIRONMENTAL GEOLOGY NOTES SERIES

1. Controlled Drilling Program in Northeastern Illinois: J. E. Hackett and G. M. Hughes. April 1965.
2. Data From Controlled Drilling Program in DuPage County, Illinois: Jean I. Larsen and C. R. Lund. May 1965.





